

AD-A109 785

D'APPOLONIA CONSULTING ENGINEERS INC PITTSBURGH PA F/G 13/13
NATIONAL DAM SAFETY PROGRAM. PUNCH BOWL DAM (INVENTORY NUMBER N--ETC(U)
SEP 81 L D ANDERSEN DACW51-81-C-0011

UNCLASSIFIED

NL

1-1
A
200000

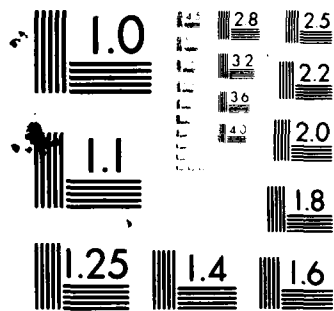
END

DATE

FILED

2 82

DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD A109785

OSWEGO RIVER BASIN
PUNCH BOWL DAM

SCHUYLER COUNTY, NEW YORK
INVENTORY NO. N.Y. 1343

"Original contains water
plates: All DTIC representa-
tions will be in black and
white"



NEW YORK DISTRICT COURT

FILE COPY



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
	40-A109785	
4. TITLE (and Subtitle) Phase I Inspection Report Punch Bowl Dam Oswego River Basin, Schuyler County, NY Inventory No. 1343		5. TYPE OF REPORT & PERIOD COVERED Phase I Inspection Report National Dam Safety Program
6. PERFORMING ORG. REPORT NUMBER		
7. AUTHOR(s) LAWRENCE D. ANDERSEN		8. CONTRACT OR GRANT NUMBER(s) DACW51-81-C-0011
9. PERFORMING ORGANIZATION NAME AND ADDRESS Appolonia Consulting Engineers, Inc. 20 Duff Road Pittsburgh, PA 15235		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Department of the Army 26 Federal Plaza New York District, CofE New York, New York 10287		12. REPORT DATE 14 September 1981
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Department of the Army 26 Federal Plaza New York District, CofE New York, NY 10287		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; Distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety National Dam Safety Program Visual Inspection Hydrology, Structural Stability Punch Bowl Dam Oswego River Basin Schuyler County		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report contains information and details on the physical condition of the dam as of the inspection. Information and analysis are based on visual inspection of the dam by the performing organization. Based on the evaluation of the existing conditions, the condition of the Punch Bowl Dam is considered to be good. The examination of documents and the visual observations did not reveal conditions which constitute a hazard to human life or property. → end page		

DD FORM 1 JAN 73 1473

USE PREVIOUS EDITIONS IS OBSOLETE

The spillway capacity was evaluated according to the recommended procedure and the dam was found to pass 100 percent of the Probable Maximum Flood (PMF) without significantly affecting the stability of the dam. Therefore, the spillway capacity is rated as adequate.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

Accession For	
NTIS GPO	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail. and/or Special
A	

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
PUNCH BOWL DAM
N.Y. 1343
DEC I.D. NO. 60C-4405
OSWEGO RIVER BASIN
SCHUYLER COUNTY, NEW YORK

TABLE OF CONTENTS

	<u>PAGE NO.</u>
ASSESSMENT	iv
OVERVIEW PHOTOGRAPH	vi
SECTION 1: PROJECT INFORMATION	1
1.1 GENERAL	1
1.2 DESCRIPTION OF PROJECT	1
1.3 PERTINENT DATA	2
SECTION 2: ENGINEERING DATA	4
2.1 DATA AVAILABLE	4
2.2 GEOLOGY	4
2.3 SUBSURFACE INVESTIGATION	4
2.4 EMBANKMENT AND APPURTENANT STRUCTURES	5
2.5 CONSTRUCTION RECORDS	5
2.6 OPERATING RECORDS	5
2.7 EVALUATION OF DATA	5
SECTION 3: VISUAL INSPECTION	6
3.1 FINDINGS	6
3.2 EVALUATION	6
SECTION 4: OPERATION AND MAINTENANCE PROCEDURES	7
4.1 PROCEDURES	7

TABLE OF CONTENTS
(Continued)

	<u>PAGE NO.</u>
4.2 MAINTENANCE OF THE DAM	7
4.3 WARNING SYSTEM IN EFFECT	7
4.4 EVALUATION	7
SECTION 5: HYDRAULIC/HYDROLOGY	8
5.1 DRAINAGE AREA CHARACTERISTICS	8
5.2 ANALYSIS CRITERIA	8
5.3 SPILLWAY CAPACITY	8
5.4 RESERVOIR CAPACITY	8
5.5 FLOODS OF RECORD	8
5.6 OVERTOPPING POTENTIAL	8
5.7 EVALUATION	9
SECTION 6: STRUCTURAL STABILITY	10
6.1 EVALUATION OF STRUCTURAL STABILITY	10
SECTION 7: ASSESSMENT/RECOMMENDATIONS	11
7.1 ASSESSMENT	11
7.2 RECOMMENDATIONS	11
<u>APPENDIX</u>	
A. PHOTOGRAPHS	
B. VISUAL INSPECTION CHECKLIST	
C. ENGINEERING DATA CHECKLIST	
D. HYDROLOGY AND HYDRAULIC ANALYSES	
E. PLATES	
F. GEOLOGY MAP	

TABLE OF CONTENTS
(Continued)

- G. STABILITY ANALYSES
- H. PREVIOUS INSPECTION REPORTS/AVAILABLE DATA*
- I. REFERENCES

*Not included due to lack of pertinent data.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Punch Bowl Dam
N.Y. 1343

State Located: New York

County Located: Schuyler

Stream: Glen Creek (a tributary of Seneca Lake)

Date of Inspection: June 25, 1981 and July 15, 1981

ASSESSMENT

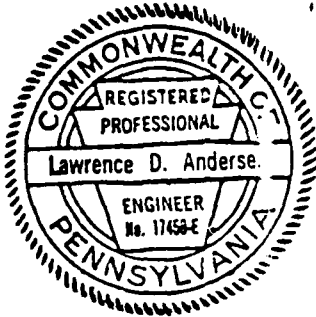
Based on the evaluation of the existing conditions, the condition of the Punch Bowl Dam is considered to be good. The examination of documents and the visual observations did not reveal conditions which constitute a hazard to human life or property.

The spillway capacity was evaluated according to the recommended procedure and the dam was found to pass 100 percent of the Probable Maximum Flood (PMF) without significantly affecting the stability of the dam. Therefore, the spillway capacity is rated as adequate.

The following recommendations should be implemented within 12 months from the final issuance date of this report:

1. An all-weather access route to the dam should be provided to permit inspection of the dam and the implementation of action in the event of an emergency during severe weather conditions.
2. Means should be developed to drain the reservoir in the event of an emergency.
3. An emergency action plan should be developed, including a formal warning system to alert the downstream residents in the event of an emergency.
4. The dam and appurtenant structures should be inspected regularly and necessary maintenance should be performed.

Assessment - Punch Bowl Dam



A handwritten signature in cursive script, appearing to read "Lawrence D. Andersen", written over a horizontal line.

Lawrence D. Andersen, P.E.
Vice President
D'Appolonia Consulting Engineers, Inc.
Pittsburgh, Pennsylvania

Approved by:

A handwritten signature in cursive script, appearing to read "W. M. Smith, Jr.", written over a horizontal line.

Col. W. M. Smith, Jr.
New York District Engineer

Date:

14 Sept 61

PUNCH BOWL DAM
N.Y. 1343
DEC I.D. 60C-4405
JUNE 25, 1981



OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
PUNCH BOWL DAM
N.Y. 1343
DEC I.D. NO. 60C-4405
OSWEGO RIVER BASIN
SCHUYLER COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I Inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

The inspection was to evaluate the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to life and property, and recommend remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Dam and Appurtenances

The Punch Bowl Dam is a concrete arch dam with a maximum height of 38 feet from the downstream toe. The dam spans a narrow gorge approximately 100 feet wide. No design and construction information is available. According to the approximate field measurements, the crest length of the arch is approximately 110 feet and the thickness of the arch at the crest level is about 5 feet. The dam appears to be a single curvature arch. Based on field measurements, the radius of curvature is about 70 feet.

A 35-foot-wide, 2-foot-deep low section, located at the center of the arch, constitutes the normal flow spillway. A gated opening through the dam, located approximately 30 feet below the dam near the right abutment, is the low level outlet facility of the structure. According to state park personnel, the low level outlet sluice gate has not been operated since the completion of the dam.

b. Location

The dam is located in Watkins Glen State Park on Glen Creek about two miles upstream from its mouth at Seneca Lake in Dix Township, Schuyler County, New York. Plate 1 illustrates the location of the dam.

c. Size Classification

The dam is classified as a small dam based on its 38-foot height and a maximum storage capacity of 190 acre-feet.

d. Hazard Classification

The dam is classified to be in the high hazard category. Downstream from the dam, Glen Creek flows through a narrow gorge in Watkins Glen State Park, and then through commercial and residential areas within the town of Watkins Glen. Finally, Glen Creek discharges into Barge Canal at the south end of Seneca Lake about two miles downstream from the dam. In Watkins Glen, the stream flows through a 50- to 60-foot-wide, 10- to 15-foot-deep channel. Based on visual observations, it is estimated that failure of the dam could cause loss of more than a few lives and appreciable property damage in both the Watkins Glen State Park and the town of Watkins Glen.

e. Ownership

The dam is owned and operated by the New York State Department of Parks and Recreation. (Address: Mr. Robert DeNardo, Park Superintendent, Watkins Glen State Park, P.O. Box 304, Watkins Glen, New York 14891, 607-535-4511).

f. Purpose of Dam

According to the Park Superintendent, the dam was designed and constructed for the purpose of controlling sediment runoff into Watkins Glen State Park.

g. Design and Construction History

No references were found to document the design and construction history of the dam. According to state files, construction of the dam was completed in 1936.

h. Normal Operating Procedure

The reservoir is normally maintained at the spillway crest level of the dam.

1.3 PERTINENT DATA

Elevations referred to in this and subsequent sections of the report were obtained from field measurements assuming the spillway crest to be at Elevation 915 (USGS Datum) which is shown as the pool level of the reservoir on the Beaver Dam 7.5-minute USGS quadrangle.

<u>a. Drainage Area</u> (sq. mi.)	21.5
<u>b. Discharge at Dam</u> (cfs)	
Spillway at top of nonoverflow section	310
<u>c. Elevation (USGS Datum) (feet)</u>	
Top of dam (overflow section)	915
Top of dam (nonoverflow section)	917

<u>d. Reservoir (acres)</u>		
Surface area at top of overflow section		12.9 ⁺ (1)
Surface area at top of nonoverflow section		13.6 [±]
<u>e. Storage Capacity (acre-feet)</u>		
Top of dam (overflow section)		160(2)
Top of dam (nonoverflow section)		190
<u>f. Dam</u>		
Type	Concrete arch	
Length	110 feet	
Height	38 feet	
Top width	5 [±] feet	
Side slopes	Downstream: Vertical	
	Upstream: Vertical	
Cutoff	Unknown	
Grout curtain	No	
<u>g. Primary Spillway</u>		
Type	Concrete overflow section	
Length	35 feet	
Crest elevation	915 feet	
<u>h. Reservoir Drain</u>		
Type	Gated opening through dam (size unknown)	
Length	Not applicable	
Access	Not accessible	
Regulatory Facility	Manually operated hoist mechanism	

(1) Planimetered from USGS 7.5-minute Beaver Dam quadrangle. Original reservoir area was reported to be 16 acres. Reservoir is now significantly silted.

(2) Design storage capacity.

SECTION 2: ENGINEERING DATA

2.1 DATA AVAILABLE

Available information was obtained from the New York State Department of Environmental Conservation, Dam Safety Division files. The only information available in the files was a field inspection checklist dated June 8, 1980. The State Parks and Recreation Department Offices in Albany and the Finger Lakes field office were contacted in an effort to obtain additional information. However, both offices reported that no design or construction information was available for the dam. An internal correspondence provided by the State Park Superintendent, dated July 6, 1972, and prepared by Mr. J. W. Miller, Senior Park Engineer, was found to include some information on the pertinent dimensions of the dam.

2.2 GEOLOGY

The Punch Bowl Dam is located in the glaciated Allegheny Plateau section of the Appalachian Plateau Province. This region is characterized as a maturely dissected plateau with the topographic features modified by continental glaciation. The modification consists of rounding off of the high areas and deposition of glacial till in the valleys.

The dam site is located near the axis of a northeast trending anticline (trending approximately north 70 degrees east). The folding is gentle with the maximum dip of the limbs of one to two degrees. The dip of the strata is affected locally by the folding; however, regionally, the rock strata dip south to southwest at approximately 100 to 150 feet per mile. The most prominent fracture orientations in the region have a strike of north 25 degrees west. Less prominent fractures strike north 75 degrees west and north 10 degrees east. Also, there is a north-trending normal fault approximately one mile west of the dam.

The rock strata in the area consist of unconsolidated Pleistocene glacial till (Wisconsin Drift) underlain by strata of the Sonyea Group (Upper Devonian Age). The glacial till consists of a mixture of clay and silt with varying quantities of gravel. The glacial till is relatively thin on hilltops and slopes and thicker in the valleys. The bedrock consists of a thick sequence of interbedded gray calcareous shale, gray and greenish-gray siltstone and silty shale, brown, gray, and dark gray shale, and black fissile shale.

2.3 SUBSURFACE INVESTIGATION

No reference was found relative to a subsurface investigation.

2.4 EMBANKMENT AND APPURTENANT STRUCTURES

As noted before, very limited information is available concerning the design and construction of the dam. Sketches in Plate 2 illustrate the plan view and typical cross section of the dam as derived from the available information. The 1972 correspondence indicates that the radius of curvature of the dam is about 70 feet. The thickness of the arch wall is reported to be five feet at crest level and seven feet at the bottom of the dam. It is also reported that the dam was keyed into the abutments in the range of 8 to 25 feet and into the foundation by about 6 feet. It is reported that steel reinforcement was provided on both faces of the dam.

2.5 CONSTRUCTION RECORDS

No construction records are available. Visual observations indicate that no postconstruction changes were instituted.

2.6 OPERATING RECORDS

No operating records are maintained.

2.7 EVALUATION OF DATA

The available information is very limited. However, in conjunction with visual observation, the available data are considered to be adequate for Phase I inspection purposes.

SECTION 3: VISUAL INSPECTIONS

3.1 FINDINGS

a. General

Visual inspections of the dam were conducted on June 25 and July 15, 1981. On both dates, the pool level was approximately at the crest level of the overflow section.

b. Dam

No identifiable signs of distress or misalignment were observed. No seepage was observed at the junction of the dam and the abutments. The base of the dam is submerged by the spillway plunge pool; therefore, it could not be inspected for signs of seepage. The concrete comprising the main structure was found to be in good condition. Some sections of the stone veneer on the crest of the dam and the concrete in the vicinity of the low level outlet were found to be deteriorating.

c. Spillway

A 35-foot-wide and approximately 2-foot-deep low overflow section on the crest of the dam constitutes the spillway of the dam. The overflow section was found to be in good condition; no significant concrete erosion was noted.

d. Reservoir Drain

A gated opening through the dam, located approximately 30 feet below the dam crest near the right abutment, constitutes the low level outlet for the facility. The sluice gate and hoist are located on the downstream side of the dam. The outlet is not accessible for inspection. According to the park superintendent, the outlet has not been operated since the completion of the dam.

e. Downstream Channel

The stream channel downstream from the dam is a deep gorge. The channel appears to be stable within the vicinity of the dam.

f. Reservoir

It appears that the reservoir is silted to within several feet of the spillway overflow crest. The original reservoir surface area is reported to have been 16 acres. Visual observations indicate that the present reservoir area is in the range of 13 acres.

3.2 EVALUATION

The dam was found to be structurally in good condition. However, the sluice gate and its hoisting equipment appear to be corroded and are reported to be nonfunctional. Minor concrete deterioration was also observed.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The reservoir is normally maintained at the spillway crest level with excess inflow discharging over the spillway. The dam has no formal operating procedure.

4.2 MAINTENANCE OF THE DAM

The dam is maintained by state park personnel. The low level outlet gate was found to be corroded and requires reconditioning. Further, the outlet is not accessible for thorough inspection or for maintenance.

4.3 WARNING SYSTEM IN EFFECT

There is no formal warning system in effect. It is reported by state park personnel that the dam is inspected following major storms. It was found that the dam is accessible by a foot path only which may not be passable during severe weather conditions.

4.4 EVALUATION

The maintenance condition of the low level outlet operating facilities is considered to be poor. These facilities should be maintained to prevent further corrosion. Access to the dam should also be improved to permit inspection of the dam and implementation of emergency action, if necessary, during severe weather conditions.

SECTION 5: HYDRAULIC/HYDROLOGY

5.1 DRAINAGE AREA CHARACTERISTICS

The Punch Bowl Dam drains an area of 21.5 square miles. The basin is comprised of woodlands, farmlands, and pasturelands. Two dams are located upstream from the Punch Bowl Dam on Glen Creek.

5.2 ANALYSIS CRITERIA

As previously stated, the Punch Bowl Dam is classified as a small dam in the high hazard category. Under the recommended criteria for evaluating spillway discharge capacity, such impoundments are required to pass one-half to full PMF.

The PMF inflow hydrograph for the reservoir was determined using the Dam Safety Version of the HEC-1 computer program developed by the Hydrologic Engineering Center of the U.S. Army Corps of Engineers. The data used for the computer input are presented in Appendix D.

5.3 SPILLWAY CAPACITY

The 35-foot-wide, 2-foot-deep low section along the crest of the dam constitutes the primary spillway. The capacity of the primary spillway is calculated to be 310 cfs. During inflow conditions in excess of the capacity of the primary spillway, the entire crest of the dam can function as an emergency spillway.

5.4 RESERVOIR CAPACITY

The original storage capacity of the dam is reported to be 160 acre-feet but the reservoir has significantly silted. The present surcharge storage capacity is estimated to be in the range of 20 to 30 acre-feet.

5.5 FLOODS OF RECORD

None available.

5.6 OVERTOPPING POTENTIAL

The PMF inflow hydrograph, determined according to the recommended procedure, was found to have a peak flow of 28,500 cfs. The capacity of the low overflow section of the dam (310 cfs) corresponds to one percent of the PMF. The 50 percent PMF peak flow is 14,200 cfs. The PMF and 50 percent PMF inflow hydrographs were routed through the reservoir and it was found that the crest of the dam would be overtopped by 11.4 feet during the 50 percent PMF and by 18.5 feet during the full PMF.

5.7 EVALUATION

The results of a preliminary stability analysis, which is discussed in Section 6, indicate that the dam will likely be stable during the passage of full PMF; therefore, the spillway capacity is considered to be adequate according to the recommended criteria.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

As discussed in Section 3, the field observations did not reveal any signs of distress that would adversely affect the stability of the dam at this time.

b. Design and Construction Data

As previously noted, very limited design information is available to aid in the assessment of the structural stability of the dam. No design drawings or calculations are available.

c. Stability Analysis

A preliminary stability analysis was conducted to determine the order of magnitude of the stresses in the arch during the passage of the full PMF. The stability analysis is included in Appendix G. A representative unity height of the dam was analyzed as an arch with pinned supports. In view of the lack of any quantitative design information, such as type and strength of the concrete and strength of the abutment rocks, a more detailed analysis could not be conducted. The results of this approximate analysis indicate that the maximum arch compressive stress is in the range of 300 psi, which is likely to be within the allowable strength of the abutment rock and the concrete used to construct the dam. Based on visual observations, the stability of the dam under normal pool conditions is considered to be adequate.

d. Postconstruction Changes

No postconstruction changes were reported.

e. Seismic Stability

The dam is located in Seismic Zone 1. Based on the recommended criteria for evaluation of the seismic stability of dams, the structure is presumed to present no hazard from earthquakes.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

Visual observations indicate that the Punch Bowl Dam is structurally in good condition. No conditions were observed that would adversely affect the stability of the structure at this time. The dam was found to pass the required spillway design flood without significantly affecting its stability. Therefore, the spillway capacity of the dam is classified to be adequate.

The operating equipment of the low level outlet was found to be in poor condition and requires maintenance. It was reported by State Park personnel that the low level outlet facility is nonfunctional. Because the reservoir has significantly silted, the low level outlet facility cannot be used to drain the reservoir. Therefore, other means of draining the reservoir should be devised to drawdown the lake in the event of an emergency condition.

Another condition noted was that the dam is accessible by a foot path only, which may not be passable under severe weather conditions. Therefore, access to the dam should be provided to permit inspection of the dam and implementation of emergency action during severe weather conditions, if necessary.

b. Adequacy of Information

Available information, in conjunction with visual observations, is considered to be sufficient to make a Phase I evaluation.

c. Need for Additional Investigations

No additional investigation is considered to be required at this time.

d. Urgency

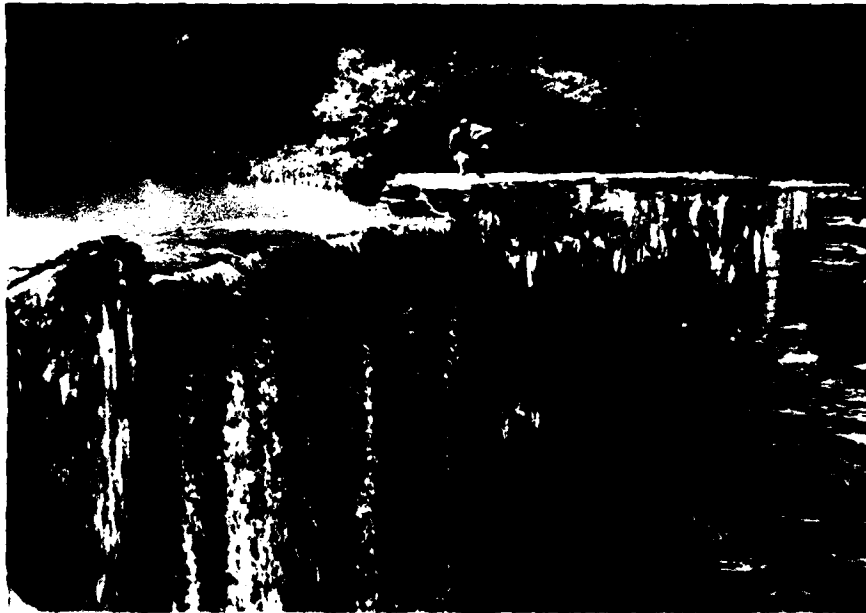
The following recommendations should be implemented within 12 months from the final issuance date of this report.

7.2 RECOMMENDATIONS

1. An all-weather access route to the dam should be provided to permit inspection of the dam and the implementation of action in the event of an emergency during severe weather conditions.
2. Means should be developed to drain the reservoir in the event of an emergency.
3. An emergency action plan should be developed, including a formal warning system to alert the downstream residents in the event of an emergency.
4. The dam and appurtenant structures should be inspected regularly and necessary maintenance should be performed.

APPENDIX A

PHOTOGRAPHS



PHOTOGRAPH NO. 1
Dam Crest (looking north)



PHOTOGRAPH NO. 2
Left Abutment



PHOTOGRAPH NO. 3
Right Abutment



PHOTOGRAPH NO. 4
Low Level Outlet Sluice Gate



PHOTOGRAPH NO. 5
Watkins Glen State Park
(1.0 mile downstream)



PHOTOGRAPH NO. 6
City of Watkins Glen
(1.5 miles downstream)

APPENDIX B

VISUAL INSPECTION CHECKLIST

APPENDIX B
VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Punch Bowl Dam
Fed. I.D. # N.Y. 1343 DEC Dam No. 60C-4405
River Basin Oswego River Basin
Location: Watkins Glen State Park, one mile south of Watkins
Glen in Schulyer County
Stream Name Glen Creek
Tributary of Seneca Lake
Latitude (N) 42° 22.4' Longitude (W) 76° 53.9'
Type of Dam Concrete arch
Hazard Category High
Date(s) of Inspection June 25, 1981 and July 15, 1981
Weather Conditions Sunny, Temp. 75 degrees
Reservoir Level at Time of Inspection El. 915 +

b. Inspection Personnel Lawrence Andersen, P.E.; James Poellot,
P.E.; Bilgin Erel, P.E.; and Michael Bort

c. Persons Contacted (Including Address & Phone No.)
Mr. Robert DeNardo, Park Superintendent, Watkins Glen State
Park, P.O. Box 304, Watkins Glen, New York 14891,
607-535-4511

d. History:

Date Constructed 1936 Date(s) Reconstructed N/A

Designer Unknown

Constructed by Unknown

Owner New York State Department of Parks and Recreation

2) Embankment

a. Characteristics

(1) Embankment Material Concrete

(2) Cutoff Type N/A

(3) Impervious Core N/A

(4) Internal Drainage System N/A

(5) Miscellaneous --

b. Crest

(1) Vertical Alignment Good

(2) Horizontal Alignment Good

(3) Surface Cracks None

(4) Miscellaneous --

c. Upstream Slope

(1) Slope (Estimate) Vertical

(2) Undesirable Growth or Debris, Animal Burrows N/A

(3) Sloughing, Subsidence or Depressions N/A

(4) Slope Protection N/A

(5) Surface Cracks or Movement at Toe None

d. Downstream Slope

(1) Slope (Estimate) Vertical

(2) Undesirable Growth or Debris, Animal Burrows N/A

(3) Sloughing, Subsidence or Depressions N/A

(4) Surface Cracks or Movement at Toe None

(5) Seepage None visible.

(6) External Drainage System (Ditches, Trenches, Blanket)
None

(7) Condition Around Outlet Structure N/A

(8) Seepage Beyond Toe None

e. Abutments - Embankment Contact

No problems observed.

(1) Erosion at Contact N/A

(2) Seepage Along Contact None

3) Drainage System

The dam has no internal drainage system.

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, etc.)

None

5) Reservoir

- a. Slopes Moderate slopes, no problems observed.
- b. Sedimentation Silted to within five to six feet of the spillway crest.
- c. Unusual Conditions Which Affect Dam None observed.

6) Area Downstream of Dam

- a. Downstream Hazard (No. of Homes, Highways, etc.) Glen Creek flows through a narrow gorge in Watkins Glen State Park; then, approximately one mile farther downstream, it flows through commercial and residential areas of the town of Watkins Glen.
- b. Seepage, Unusual Growth None
- c. Evidence of Movement Beyond Toe of Dam None
- d. Condition of Downstream Channel Good

7) Spillway(s) (Including Discharge Conveyance Channel)

- a. General Service Spillway: A low overflow section of the dam constitutes the spillway.
- b. Condition of Service Spillway Good

c. Condition of Auxiliary Spillway N/A

d. Condition of Discharge Conveyance Channel N/A

8) Reservoir Drain/Outlet

Type: Pipe _____ Conduit _____ Other Opening through dam

Material: Concrete _____ Metal _____ Other Unknown

Size: Unknown Length _____

Invert Elevations: Entrance Unknown Exit Unknown

Physical Condition (Describe): Not observable.

Material: --

Joints: -- Alignment --

Structural Integrity: --

Hydraulic Capability: --

Means of Control: Gate X Valve _____ Uncontrolled _____

Operation: Operable _____ Inoperable X Other _____

Present Condition (Describe): The reservoir drain is
reported to be inoperable.

9) Structural

- a. Concrete Surfaces The dam appears to generally be in
good condition with some spalling near the right abutment
and near the low level outlet gate.
- b. Structural Cracking None observed.
- c. Movement - Horizontal & Vertical Alignment (Settlement)
None observed.
- d. Junctions with Abutments or Embankment.
No problems observed.
- e. Drains - Foundation, Joint, Face
No problems observed.
- f. Water Passages, Conduits, Sluices
N/A
- g. Seepage or Leakage None observed.

h. Joints - Construction, etc. No problems observed.

i. Foundation Not visible.

j. Abutments N/A

k. Control Gates Reported to be inoperable.

l. Approach & Outlet Channels Good

m. Energy Dissipators (Plunge Pool, etc.) None

n. Intake Structures N/A

o. Stability N/A

p. Miscellaneous ---

10) Appurtenant Structures (Power House, Lock, Gatehouse, Other)

a. Description and Condition None

APPENDIX C
ENGINEERING DATA CHECKLIST

APPENDIX C
ENGINEERING DATA CHECKLIST
NAME OF DAM: PUNCH BOWL DAM

AREA-CAPACITY DATA:

	<u>Elevation (feet)</u>	<u>Surface Area (acres)</u>	<u>Storage Capacity (acre-feet)</u>
1) Top of Dam	<u>917.0</u>	<u>13.6</u>	<u>190.0</u>
2) Design High Water (Max. Design Pool)	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
3) Auxiliary Spillway Crest	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
4) Service Spillway Crest	<u>915.0</u>	<u>13.9</u>	(design value) <u>160.0</u>
5) Crest of Orifice (Normal Pool)	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>

DISCHARGES

	<u>Discharge (cfs)</u>
1) Average Daily	<u>50⁺</u>
2) Auxiliary Spillway at Maximum High Water ⁽¹⁾	<u>28,490</u>
3) Auxiliary Spillway at Design High Water	<u>N/A</u>
4) Principal Spillway at Auxiliary Spillway Crest Elevation	<u>310</u>
5) Low Level Outlet	<u>N/A</u>
6) Total of All Facilities at Maximum High Water ⁽¹⁾	<u>28,490</u>
7) Maximum Known Flood	<u>Unknown</u>
8) At Time of Inspection	<u>50⁺</u>

⁽¹⁾ Maximum high water is assumed to equal the full PMF. The dam is capable of passing the full PMF.

DAM: Punch Bowl Dam

CREST ELEVATION: 917.0

Type: Concrete arch

Width: 5 feet Length: 110 feet

Spillover: Low overflow section of the dam.

Location: Center of the dam.

SPILLWAY:

SERVICE		AUXILIARY (Entire dam crest)
<u>915.0</u>	Elevation	<u>917</u>
<u>Overflow section</u>	Type	<u>Dam crest</u>
<u>35-foot</u>	Width	<u>5 feet</u>
	<u>Type of Control</u>	
<u>Uncontrolled</u>	Uncontrolled	<u>N/A</u>
	Controlled	
<u>N/A</u>	Type (Flashboards; Gate)	<u>N/A</u>
<u>N/A</u>	Number	<u>N/A</u>
<u>N/A</u>	Size/Length	<u>N/A</u>
<u>Concrete</u>	Invert Material	<u>N/A</u>
<u>N/A</u>	Anticipated Length of Operating Service	<u>N/A</u>
<u>N/A</u>	Chute Length	<u>N/A</u>
<u>5 to 6 feet</u>	Height Between Spillway Crest and Approach Channel Invert (Weir Flow)	<u>7 to 8 feet</u>

Hydrometeorological Gages:

Type: None

Location: N/A

Records:

Date - N/A

Max. Reading - N/A

FLOODWATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (Mechanisms):

None

DRAINAGE AREA: 21.5 square miles

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Woodlands, farmlands, and pasturelands

Terrain - Relief: Moderate to steep slopes

Surface - Soil: Low permeability

Runoff Potential (existing or planned extensive alterations to existing surface or subsurface conditions)

Moderate to high runoff potential due to moderate to steep slopes and low infiltration rate.

Potential Sedimentation Problem Areas (natural or man-made; present or future)

Punch Bowl Dam was designed and constructed to act as a sediment collection basin and is presently silted into within five to six feet of its spillway crest. Thus, there is an erosion problem within the watershed, the problem most likely associated with the farmland areas.

Potential Backwater Problem Areas for Levels at Maximum Storage Capacity Including Surge Storage:

None observed.

Dikes - Floodwalls (overflow and nonoverflow) - Low Reaches Along the Reservoir Perimeter:

Location: None

Elevation:

Reservoir:

Length at Maximum Pool: 2,400[±] feet

Length of Shoreline at Normal Pool: 3,700[±] feet

APPENDIX D

HYDROLOGY AND HYDRAULIC ANALYSES

HYDROLOGY AND HYDRAULIC ANALYSIS DATA BASE

NAME OF DAM: Punch Bowl Dam (NY DEC 60C-4405)

PROBABLE MAXIMUM PRECIPITATION (PMF) = 21.5 INCHES/24 HOURS⁽¹⁾

STATION	1	2	3	4	5
Station Description	Punch Bowl Lake	Punch Bowl Dam			
Drainage Area (square miles)	21.5	—			
Cumulative Drainage Area (square miles)	21.5	21.5			
Adjustment of PMF for Drainage Area (%)					
6 Hours	111	—			
12 Hours	123	—			
24 Hours	132	—			
48 Hours	142	—			
72 Hours	—	—			
Snyder Hydrograph Parameters					
C_p/C_t (2)	0.60/2.0	—			
L (miles) (3)	8.0	—			
L_{ca} (miles) (3)	3.5	—			
$t_p = C_t(L \cdot L_{ca})^{0.3}$ (hours)	5.3	—			
Spillway Data					
Crest Length (ft)	—	35.0			
Freeboard (ft)	—	2.0			
Discharge Coefficient	—	3.1			
Exponent	—	1.5			

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Snyder's Coefficients.

(3) L = Length of longest water course from outlet to basin divide.

L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS															
				RATIO 1 .05	RATIO 2 .10	RATIO 3 .20	RATIO 4 .30	RATIO 5 .40	RATIO 6 .50	RATIO 7 .70	RATIO 8 .80	RATIO 9 1.00							
HYDROGRAPH AT	1	21.50 55.68	1 (40.33)	1424. (2849. 80.67)	5698. (161.34)	8540. (242.01)	11395. (322.67)	14244. (413.34)	19947. (564.68)	2279. (645.35)	2848. (806.69)	3540. (1000.00)	4244. (1200.00)	5047. (1400.00)	5849. (1600.00)	6647. (1800.00)	7449. (2000.00)	8247. (2200.00)	
	2	21.50 55.68	1 (40.31)	1423. (2848. 80.65)	5657. (161.33)	8540. (242.00)	11395. (322.67)	14244. (413.33)	19947. (564.66)	2279. (645.32)	2848. (806.62)	3540. (1000.00)	4244. (1200.00)	5047. (1400.00)	5849. (1600.00)	6647. (1800.00)	7449. (2000.00)	8247. (2200.00)	

SUMMARY OF DAM SAFETY ANALYSIS

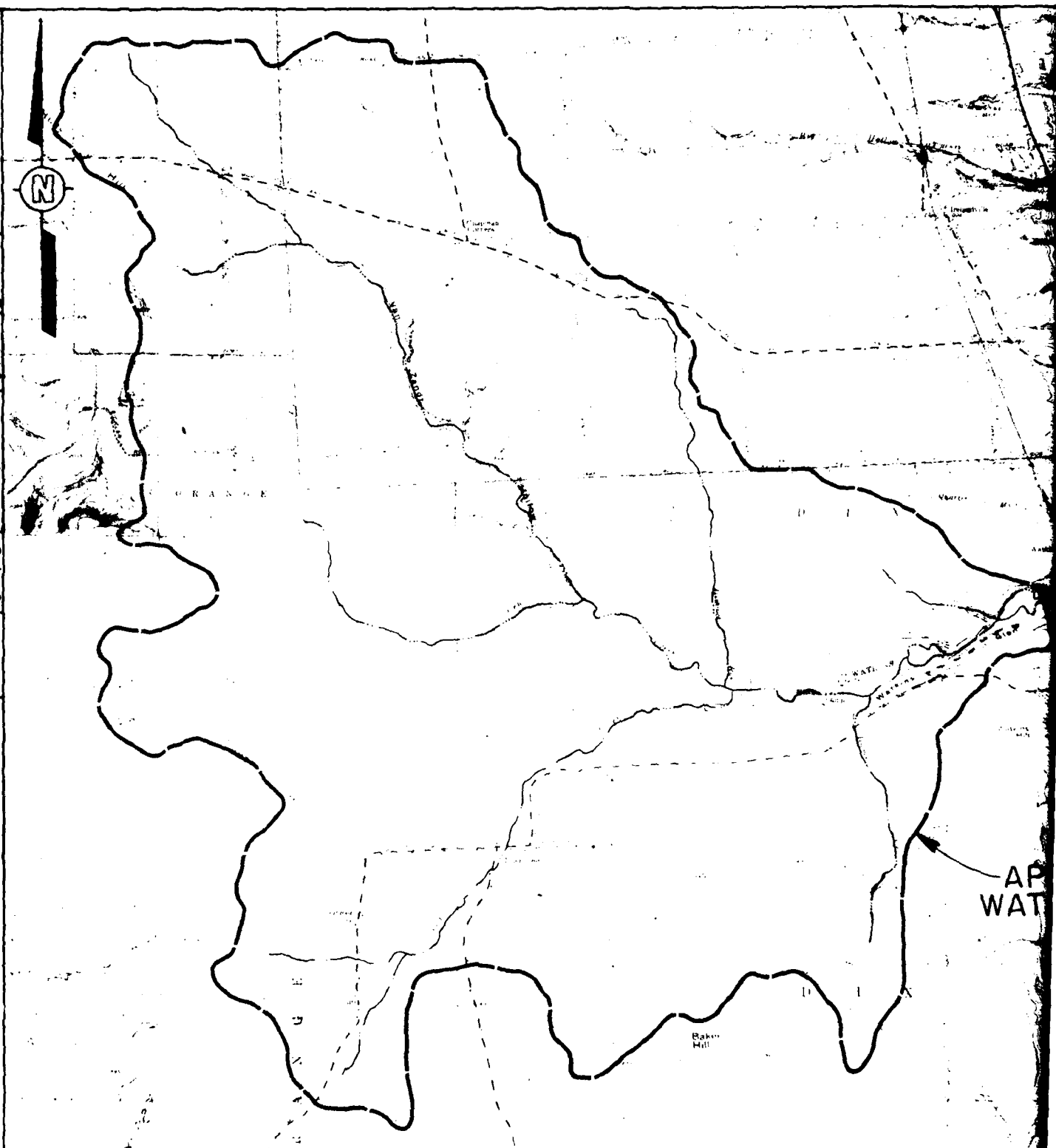
PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 915.00 163. 0.	SPILLWAY CREST 915.00 163. 0.	TOP OF DAM 917.00 190. 307.	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS			
.05	918.87	1.87	216.	1423.	15.00	45.00	0.00
.10	920.43	3.43	239.	2868.	20.50	45.00	0.00
.20	922.87	5.87	277.	5697.	27.00	45.00	0.00
.30	924.90	7.90	311.	8566.	31.50	45.00	0.00
.40	926.72	9.72	343.	11395.	37.50	45.00	0.00
.50	928.38	11.38	374.	14244.	41.50	45.00	0.00
.70	931.42	14.42	435.	19941.	52.00	45.00	0.00
.80	932.82	15.82	464.	22789.	53.00	45.00	0.00
1.00	935.46	18.46	519.	28486.	55.00	45.00	0.00

APPENDIX E

PLATES

DRAWN BY A Smith
 CHECKED BY JAC
 APPROVED BY JHP
 8-4-81
 8-1-81
 8-11-81
 DRAWING NUMBER 80-778-B52

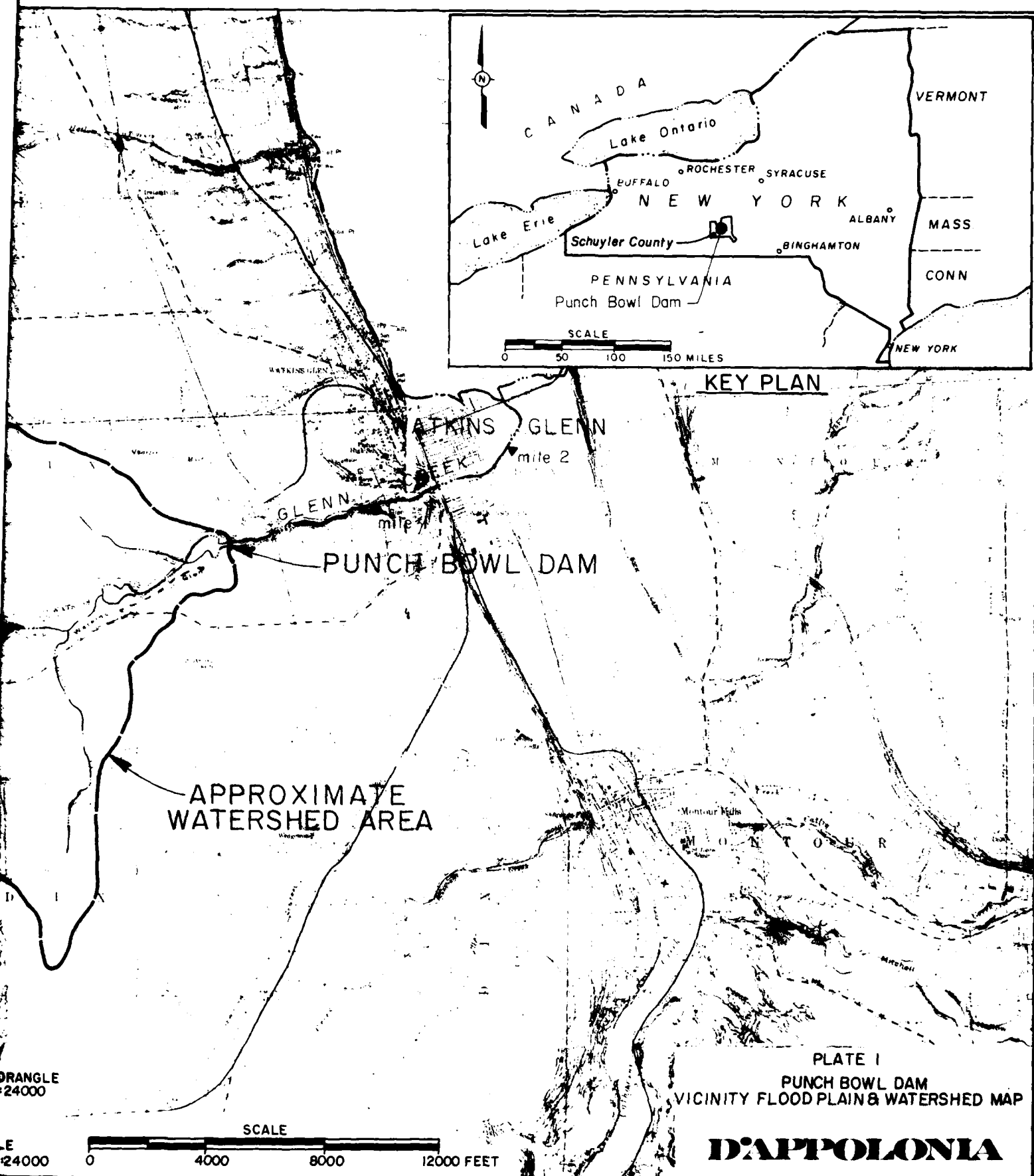
23



REFERENCE:

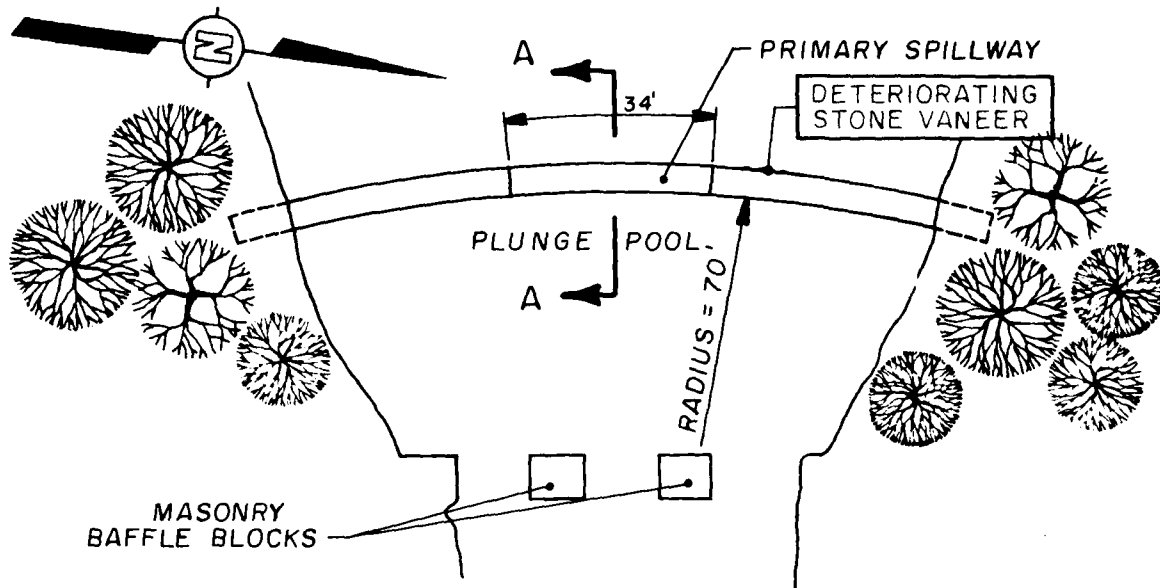
- | | |
|--|---|
| 1. 7.5 MIN. U.S.G.S. READING CENTER, N.Y. QUADRANGLE
DATED: 1950, PHOTOREVISED: 1978, SCALE 1:24000 | 4. 7.5 MIN. U.S.G.S. MONTAUR FALLS, N.Y. QUADRANGLE
DATED: 1950, PHOTOREVISED: 1978, SCALE 1:24000 |
| 2. 7.5 MIN. U.S.G.S. BEAVER DAMS, N.Y. QUADRANGLE
DATED: 1953, SCALE 1:24000 | 5. 7.5 MIN. U.S.G.S. WAYNE, N.Y. QUADRANGLE
DATED: 1953, SCALE 1:24000 |
| 3. 7.5 MIN. U.S.G.S. BURDETT, N.Y. QUADRANGLE
DATED: 1950, SCALE 1:24000 | 6. 7.5 MIN. U.S.G.S. BRADFORD, N.Y. QUADRANGLE
DATED: 1953, PHOTOREVISED: 1978, SCALE 1:24000 |

0 400

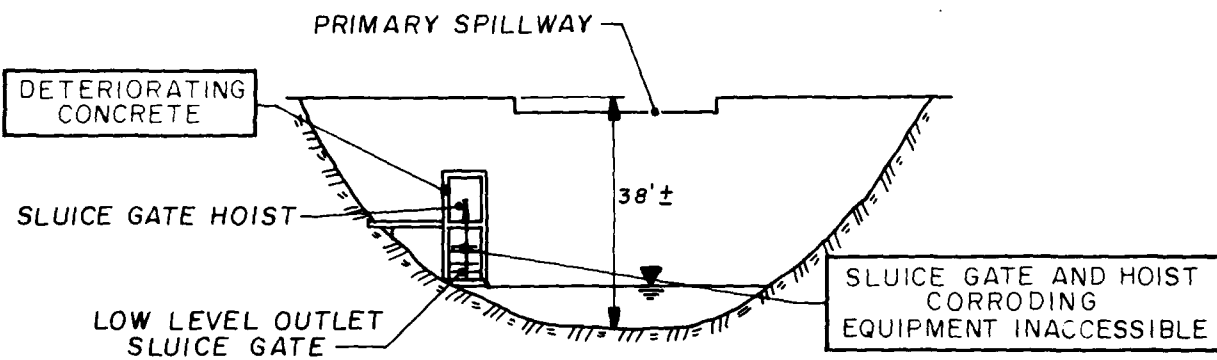


D'APPOLONIA

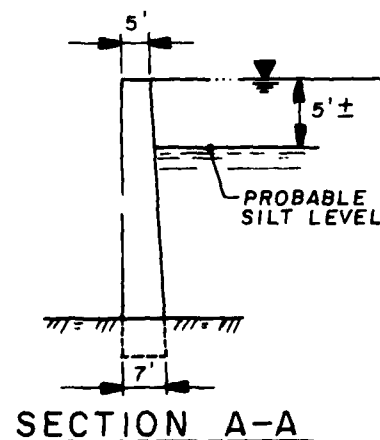
DRAWN BY A Smith 8-4-81
 CHECKED BY AE 8-5-81
 APPROVED BY JHP 8/5/81
 DRAWING NUMBER 80-778-A10



PLAN



ELEVATION



SECTION A-A

NOTE:

POOL LEVEL AT DATE OF
 INSPECTION: PRIMARY
 SPILLWAY CREST.

PLATE 2

PUNCH BOWL DAM
 GENERAL PLAN
 FIELD INSPECTION NOTES
 FIELD INSPECTION DATE: JUNE 25, 1981

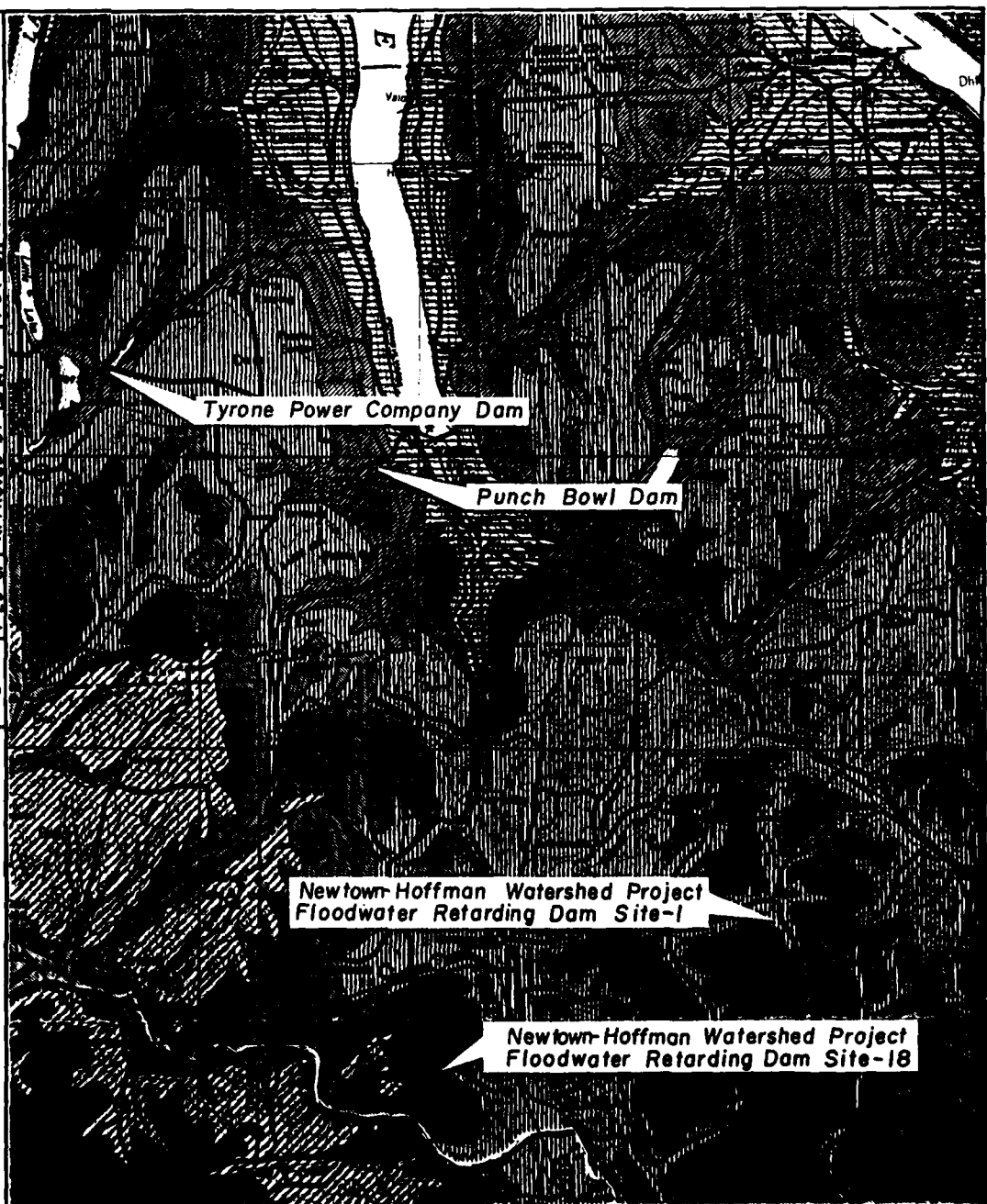
D'APPOLONIA

NOT TO SCALE

APPENDIX F

GEOLOGY MAP

DRAWN BY
 CHECKED BY
 ACS
 4-29-81
 APPROVED BY
 7-14-81
 DRAWING 80-778-A4
 NUMBER



GEOLOGY MAP

REFERENCE
 GEOLOGIC MAP OF NEW YORK, FINGER LAKES SHEET
 DATED: 1970, SCALE 1:250,000

D'APPOLONIA

DRAWN BY: ACS
 CHECKED BY: 3E
 4-29-81
 APPROVED BY: 5-7-81
 DRAWING NUMBER 80-778-A6

LEGEND

CANADAWAY GROUP

800-1200 ft. (240-370 m.)



Dv Machias Formation—shale, siltstone. Rushford Sandstone; Caneadea, Canisteo, and Hume Shales. Canaseraga Sandstone. South Wales and Dunkirk Shales in Pennsylvania. Towanda Formation—shale, sandstone.

JAVA GROUP

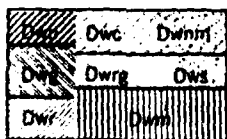
300-700 ft. (90-210 m.)



Dt Wiscoy Formation—sandstone, shale. Hanover and Pipe Creek Shales.

WEST FALLS GROUP

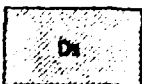
1100-1600 ft. (340-490 m.)



Dwn Nunda Formation—sandstone, shale.
 Dwc West Hill and Gardeau Formations—shale, siltstone; Roricks Glen Shale; upper Beers Hill Shale; Grimes Siltstone.
 Dwr lower Beers Hill Shale; Dunn Hill, Millport, and Moreland Shales.
 Dwg Nunda Formation—sandstone, shale; West Hill Formation—shale, siltstone; Corning Shale.
 Dws "New Milford" Formation—sandstone, shale.
 Dwm Gardeau Formation—shale, siltstone; Roricks Glen Shale.
 Dwn Slide Mountain Formation—sandstone, shale, conglomerate.
 Dwm Beers Hill Shale; Grimes Siltstone; Dunn Hill, Millport, and Moreland Shales.

SONYEA GROUP

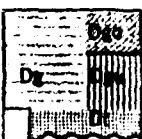
200-1000 ft. (60-300 m.)



Ds In west: Cashaqua and Middlesex Shales. In east: Rye Point Shale; Rock Stream ("Enfield") Siltstone; Pulteney, Sawmill Creek, Johns Creek, and Montour Shales.

GENESEE GROUP AND TULLY LIMESTONE

200-1000 ft. (60-300 m.)



Dg West River Shale; Genundewa Limestone; Penn Yan and Genesee Shales; all except Genesee replaced eastwardly by Ithaca Formation—shale, siltstone and Sherburne Siltstone.
 Dgo Oneonta Formation—shale, sandstone.
 Dge Unadilla Formation—shale, siltstone.
 Dt Tully Limestone.

LOCKPORT GROUP

80-175 ft. (25-55 m.)



Sl Oak Orchard and Penfield Dolostones, both replaced eastwardly by Sconondoa Formation—limestone, dolostone.

GEOLOGY MAP LEGEND

REFERENCE

GEOLOGIC MAP OF NEW YORK, FINGER LAKES SHEET
 DATED: 1970, SCALE: 1:250,000

D'ARPOLONIA

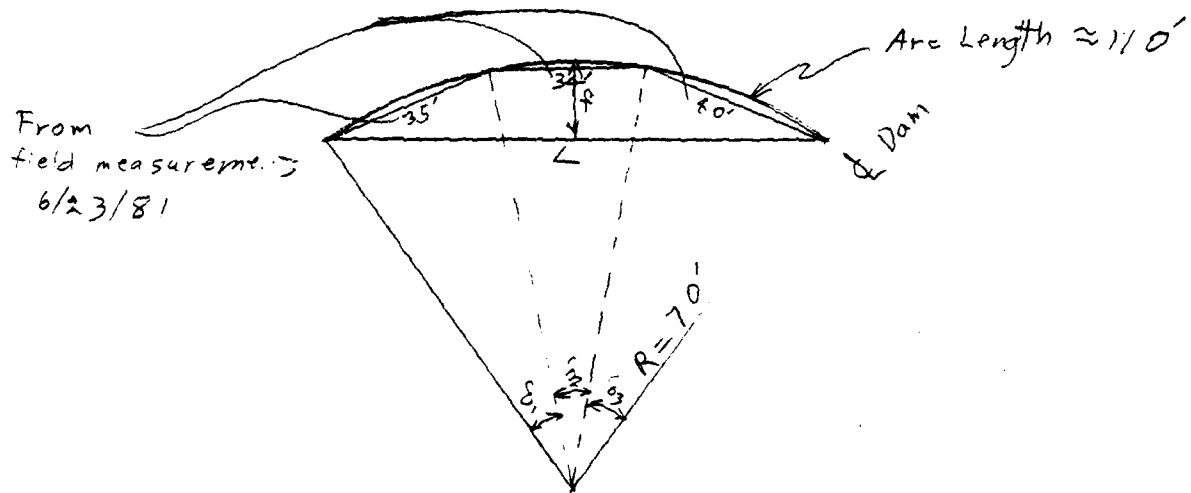
APPENDIX G
STABILITY ANALYSES

D'APPOLONIA

CONSULTING ENGINEERS, INC.

By J.A.E. Date 7/28/81 Subject Punch Bowl Dam Sheet No. 1 of 7
 Chkd. By J.W. Date 08-05-81 STABILITY CALCULATIONS Proj. No. 80-778

Geometric data on this arch dam is shown below in plan.



This data was obtained from a copy of an internal memorandum from J.W. Miller, Sr Park Engineer, N.Y. State Parks & Recreation Dept., 7/6/72.

Compute Angles

$$\begin{aligned}\delta_1 &= 2 \left\{ \sin^{-1} \left(\frac{12.5}{70.0} \right) \right\} = (14.28) 2 = 28.96^\circ \\ \delta_2 &= 2 \left\{ \sin^{-1} \left(\frac{13.0}{70.0} \right) \right\} = (14.06) 2 = 28.11^\circ \\ \delta_3 &= 2 \left\{ \sin^{-1} \left(\frac{25}{70} \right) \right\} = (33.20) 2 = 66.40^\circ\end{aligned}$$

$$\text{Arc Length } L = 2\pi \left(\frac{90.27}{360} \right) (70.0) = 110.28'$$

$$L = 2 R \sin \left(\frac{90.27}{2} \right)^\circ = 2 (70) (0.700) = 98.00'$$

$$L = R - r \cos \left(\frac{90.27}{2} \right)^\circ = 70 (1 - 0.705) = 20.65'$$

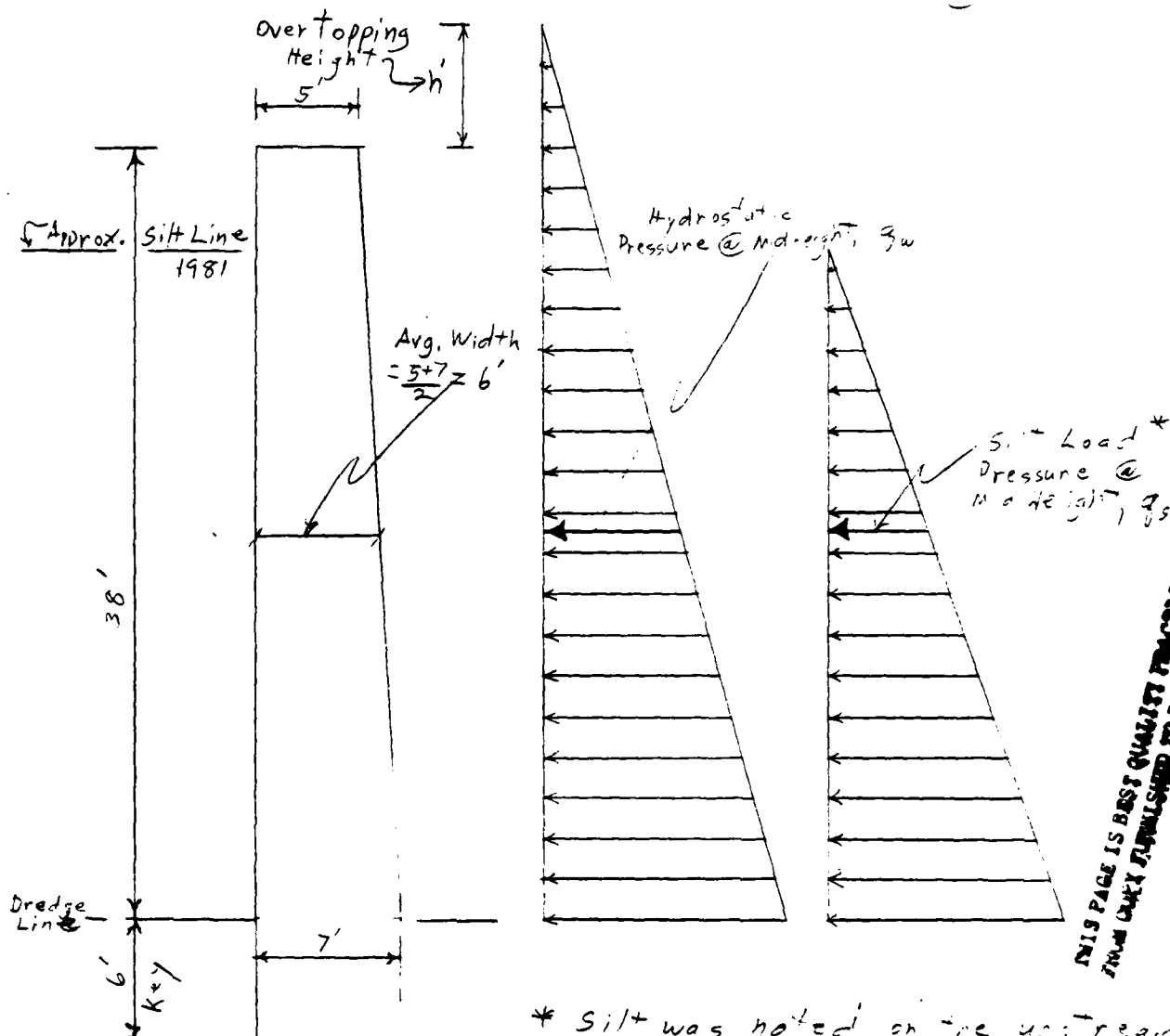
$$\text{Arch Angle } \phi = \frac{1}{2} \Delta = \frac{90.27}{2} = 45.14^\circ$$

D'APPOLONIA

CONSULTING ENGINEERS, INC.

By J.A.E. Date 7/28/81 Subject Punch Bowl Dam Sheet No. 2 of 7
 Chkd. By PM Date 08-05-81 STABILITY CALCULATIONS Proj. No. 80-778

Typical Cross-Section of Dam & Loading



* Silt was noted on the upstream face of the dam approximately 5' or 6' below the crest. Assume that the silt is 5' below the dam crest, (Per Conversation with J.E. 7/28/81)

Typical values of unit weight of loose silt are 90-100 pcf (J.E. Bowles, Physical & Geotechnical Engineering, 2nd ed., McGraw-Hill, p. 154), $\gamma_{sat} = 130$ pcf

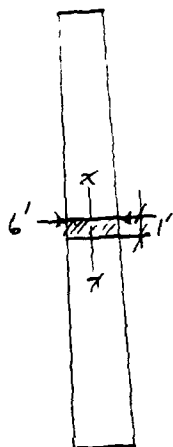
THIS PAGE IS BEST QUALITY PRINTING
 FROM OUR PUBLISHED TO NEW

D'APPOLONIA

CONSULTING ENGINEERS, INC.

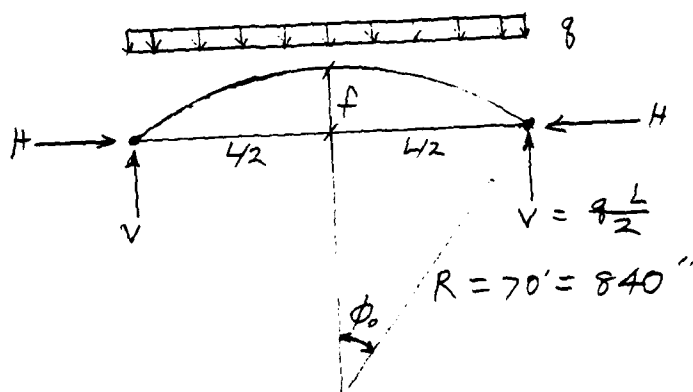
By V.E. Date 7/27/81 Subject Punch Bowl Dam Sheet No. 3 of 7
 Chkd. By [Signature] Date 08-05-81 STABILITY CALCULATIONS Proj. No. 80-778

Consider a 1 ft. thick section at the mid height of the dam. (Ignore Poisson's effect, axial & shear deformations)



$$\text{Slice Area} = (6 \times 12)(1 \times 12) = 864 \text{ in}^2$$

$$I_{x-x} = \frac{bd^3}{12} = \frac{(12)(72)^3}{12} = (72)^3 = 373,248 \text{ in}^4$$



Assume that the structure may be analyzed as a two-hinged circular arch

$$H = \frac{\int M_x' y \frac{ds}{EI} - \int P_s' \frac{dz}{EA}}{\int y^2 \frac{ds}{EI} - \int \left(\frac{dx}{ds}\right) \frac{dx}{EA}} \quad (\text{Eq. 6-2.7, Ref. 1})$$

$$\text{where } \int M_x' y \frac{ds}{EI} = \frac{q R^4}{EI} \left\{ \frac{2}{3} \sin^3 \phi_0 - \phi_0 \cos \phi_0 \sin^2 \phi_0 + \frac{1}{2} \phi_0 \cos \phi_0 - \frac{1}{2} \sin \phi_0 \cos^2 \phi_0 \right\} \quad (\text{Ref. 1, p. 17})$$

$$\int P_s' \frac{dz}{EA} = \frac{2 q R^2}{3 EA} \{ \sin^3 \phi_0 \} \quad (\text{Ref. 1, p. 17})$$

Ref. 1. Willems, N. and W.M. Lucas, Jr., Structural Analysis For Engineers, McGraw-Hill, 1978.

D'APPOLONIA

CONSULTING ENGINEERS, INC.

By J.A.E. Date 7/29/81 Subject Punch Bowl Dam Sheet No. 4 of 7
Chkd. By BW Date 08-05-81 STABILITY CALCULATIONS Proj. No. 80-778

$$\int y^2 \frac{ds}{EI} = \frac{R^3}{EI} \{ \phi_0 + 2\phi_0 \cos^2 \phi_0 - 3 \sin \phi_0 \cos \phi_0 \}$$

$$\int \left(\frac{dx}{ds} \right) \frac{dx}{EA} = \frac{R}{EA} \{ \phi_0 + \sin \phi_0 \cos \phi_0 \}$$

we have $\phi_0 = 45.14^\circ = 0.788 \text{ rad.}$
 $R = 840''$
 $I = 373,248 \text{ in}^4$
 $A = 864 \text{ in}^2$

The modulus of elasticity, E , will divide out of the equation for H .

Then
$$\int M_s' y \frac{ds}{I} = \frac{q(840)^4}{373248} \left\{ \frac{2}{3}(0.356) - 0.788(0.354) + 0.278 - 0.176 \right\}$$

$$= \frac{(840)^4}{373248} \{ 0.060 \} q = 79676 \cdot q$$

$$\int p_s' \frac{dz}{A} = \frac{2q(840)^2}{3(864)} \{ (0.709)^3 \} = 194 \cdot q$$

$$\int y^2 \frac{ds}{I} = \frac{(840)^3}{373248} \{ 0.072 \} = 114.60$$

$$\int \left(\frac{dx}{ds} \right) \frac{dx}{A} = \frac{840}{864} \{ 0.788 + (0.709)(0.705) \} = 1.25$$

$$\rightarrow H = \frac{79676 \cdot q - 194 \cdot q}{114.60 - 1.25} = \underline{\underline{701.3 \cdot q}}$$

From the attached summary of the HEC-1 computer program run for this dam, cresting depth @ 100% PMF = 18.43' \approx 18.5' = h

D'APPOLONIA

CONSULTING ENGINEERS, INC.

By J.E. Date 7/30/81 Subject Punch Bowl Dam Sheet No. 5 of 7
 Chkd. By RM Date 08-05-81 STABILITY CALCULATIONS Proj. No. 80-778

Assuming that $k_0 = 1.0$ for the silt loading, the horizontal pressure at the midheight of the dam can be computed.

$$P = q_w + q_s = (18.5 + 14.0) 62.4 + (14.0) 37.6$$

(@ 100% PMF)

$$= 2340 + 526.4 = 2866.4 \text{ psf}$$

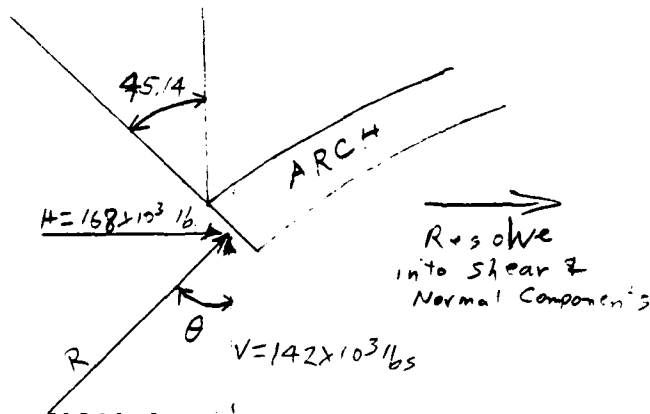
Avg. Loading Per Incl. Arc Length $= \frac{2866.4}{12} \approx 239 \text{ lb/in}$

$$\rightarrow H = 701.3 (239) = 167,594 \text{ lbs.}$$

$$V = \frac{qL}{2} = \frac{(2866.4)(99.23)}{2} = 142,216 \text{ lbs.}$$

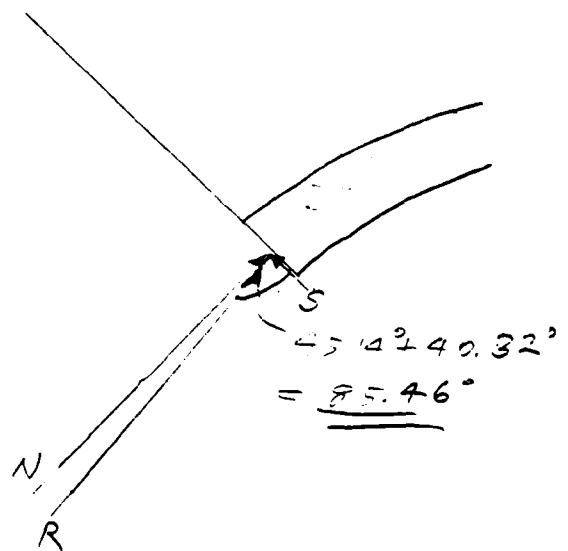
Resultant $R = (H^2 + V^2)^{1/2} = 219,802 \text{ lbs}$

$$\theta = \sin^{-1} \left(\frac{142,216}{219,802} \right) = 40.32^\circ$$



$$S = R \cos(85.46^\circ) = 17409 \text{ lb.}$$

$$N = R \sin(85.46^\circ) = 219112 \text{ lb.}$$



D'APPOLONIA

CONSULTING ENGINEERS, INC.

By J.A.P. Date 7/30/81 Subject Dunch Bowl Dam Sheet No. 6 of 7
Chkd. By J.W. Date 08-05-81 STABILITY CALCULATIONS Proj. No. 80-778

Stresses on faces of abutments

$$\text{Shear} = S/A = (17409/864) = 20.6 \text{ psi.}$$

$$\text{Compression} = N/A = (219112/864) = 253.6 \text{ psi.}$$

Observations at the site indicate that abutment rock is composed of calcareous and/or silt, shales, primarily, with some siltstone also reported.

According to ETL 1110-2-18f, the lowest strength parameters for shales listed are for the Dogonia Shale. These parameters will be used in this calculation.

$$\phi = 28^\circ, S = 40 \text{ psi}$$

Factor of Safety - Abutment Sliding

$$\text{Shear Strength} = (\Sigma V) \tan \phi + S(\text{Area})$$

$$= N \tan 28^\circ + (40.0)(864.0)$$

$$= 219112(0.52) + 34560 = 151064 \text{ lbs.}$$

$$F = \text{Shear Strength} / \text{Shear} = 151064 / 17409$$

$$= 8.68 > 4 \rightarrow \text{OK}$$

253 psi compression is OK. In addition even if Poisson's effects are multiplied by 2 or 3.

THIS PAGE IS BEST QUALITY REPRODUCTION
FROM COPY FURNISHED TO BRS

D'APPOLONIA

CONSULTING ENGINEERS, INC.

By J.A.E. Date 7/30/81 Subject Punch Bowl Dam
Chkd. By PM Date 08-05-81 STABILITY CALCULATION

Sheet No. 7 of 7

Proj. No. 80-7-8

CHECK MID SPAN STRESS AT MID HEIGHT

$$\text{Moment @ Midspan} = M = V\left[\frac{L}{2}\right] - \left(\frac{g}{2}\right)\frac{L}{4} - H[F]$$

$$\text{we have } V = \frac{gL}{2} \rightarrow M = \frac{gL^2}{4} - \frac{gL^2}{8} - H[F]$$

$$\rightarrow M = \frac{gL^2}{8} - H[F]$$

$$\rightarrow M = \frac{(239)(99.23 \times 12)^2}{8} - (167594)(20.62 \times 12)$$

$$= 42.36 \times 10^6 - 41.47 \times 10^6$$

$$= 8.9 \times 10^5 \text{ in-lb.}$$

$$\sigma = \frac{H}{A} = \frac{M}{S} \quad , \quad S = \frac{bd^2}{6} = \frac{12(72)^2}{6} = 10368$$
$$= \frac{167594}{864} = \frac{8.9 \times 10^5}{10368} = 194 \pm 86 \text{ psi.}$$

Tensile stress = 0 Max. Compressive stress = 280 psi

Allowable compressive stress assuming a concrete strength of 3000 psi. = $\frac{1}{3}f'_c$

$$\frac{1}{3}f'_c = 0.45 f'_c = \underline{350 \text{ psi.}}$$

Stresses are O.K.

THIS PAGE IS BEST QUALITY PRINT
FROM COPY FURNISHED TO DOD

APPENDIX I

REFERENCES

APPENDIX I

REFERENCES

Broughton, J. G., D. W. Fisher, Y. W. Isachsen, and L. V. Rickard, 1966, "Geology of New York," New York State Museum and Science Service, Educational Leaflet 20, 50 pp.

Fisher, D. W., Y. W. Isachsen, and L. V. Rickard, 1971, "Generalized Tectonic-Metamorphic Map of New York," New York Museum and Science Service, Map and Chart Series No. 15.

Flint, R. F., 1971, Glacial and Quaternary Geology, John Wiley and Sons, Inc., 892 pp.

Rickard, L. V. and D. W. Fisher, 1970, "Geologic Map of New York, Finger Lakes Sheet," New York State Museum and Science Service, Map and Chart Series No. 15.

Thornburg, W. D., 1965, Regional Geomorphology of the United States, John Wiley & Sons, Inc., 609 pp.

U.S. Army Corps of Engineers, 1956, Hydrometeorological Report No. 33.

U.S. Department of Commerce, 1965, Weather Bureau Hydrometeorological Report No. 40.

U.S. Department of the Interior, Bureau of Reclamation, 1974, Design of Small Dams.

Wright, H. E., Jr. and D. G. Frey, 1965, The Quaternary of the United States, Princeton University Press, 922 pp.

**DAT
FILM**